Risk factors for respiratory infections among children attending day care centres

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Abstract

Background. Upper respiratory tract infection (URTI), lower respiratory tract infection (LRTI) and acute otitis media (AOM) are common in children attending day care centres.
Objectives. This study aimed to characterize the risk factors of URTI, LRTI and AOM in children attending day care.
Methods. A cross-sectional study was conducted in children aged up to 3 years (n = 152) of six day care centres in Porto. Logistic regression was used on independent variables: mother-related, household-related, child-related and day care-related risk factors as predictors of the dependent variables: URTI, LRTI and AOM.
Results. The risk of URTI increased as the number of children decreased [odds ratio (OR) = 0.620, 95% CI = 0.411–0.935], as the area per child decreased (OR = 0.434, 95% CI = 0.206–0.914) and as the disinfection of WC/diapers-change increased (OR = 2.56, 95% CI = 1.089–6.017). There was a higher risk of URTI if nasal aspirators (OR = 6.763, 95% CI = 1.022–44.753), rather than physiologic serum (OR = 5.296, 95% CI = 1.097–25.559), were used at day care centres. The risk of LRTI increased as the household size decreased (OR = 0.213, 95% CI = 0.048–0.937) and it was higher if the child had no siblings (OR = 7.831, 95% CI = 1.065–57.578). The risk of LRTI was higher if the child was not exclusively breastfed (OR = 24.612, 95% CI = 1.108–546.530) and the risk increased as the duration of exclusive breastfeeding decreased (OR = 0.396, 95% CI = 0.170–0.920). The risk of AOM increased as the birth body mass index (OR = 2.247, 95% CI = 1.011–4.992) and weight (OR = 1.607, 95% CI = 1.014–2.545) increased and if nasal aspirators were used (OR = 6.763, 95% CI = 1.022–44.753).
Conclusion. URTI were related with day care centres' risk factors, LRTI were associated with mother-related and household-related risk factors and AOM was connected with child-related risk factors.

Key words. At-risk groups, ear, nose and throat (ENT, otolaryngology), health promotion, paediatrics, upper respiratory infections/common cold/bronchitis.

Introduction

Acute respiratory infections (ARI) are the main cause of worldwide morbidity in children younger than 5 years (1,2). Existing studies on ARI risk factors mainly focus on nutritional or environmental variables such as home overcrowding, indoor air pollution, malnutrition, incomplete immunization and socio-economic status (3,4). However, the majority of these risk factors are not present in European urban developed regions, but the incidence and prevalence of ARI in these areas are growing (2,3). Urban developed societies promote behaviours associated with different risk factors related to early attendance of nurseries or day care centres (5). The high density of children at the daycare, along with anatomical and social behaviour characteristics, promotes dissemination of

ARI and increases the number of associated episodes of acute otitis media (AOM) (1,6,7).

Therefore, there is a need to explore specific risk factors of ARI and AOM in a day care situation so as to develop primary health care measures that may reduce their prevalence in children.

This study aimed to characterize the risk factors of upper respiratory tract infection (URTI), lower respiratory tract infection (LRTI) and AOM in children under 36 months of age attending day care centres in Porto, Portugal.

Methods

In accordance with the STROBE Statement, a cross-sectional study was conducted during winter (January to March) in six random private day care centres from Oporto. It involved children aged up to 3 years of both genders and excluded children with chronic neuromuscular or cardiorespiratory diseases.

A Diary of Records was handed to the children's caregivers with questions concerning the month preceding the date of the survey. It included questions about: (i) caregivers' socio-demographic status and mother-related risk factors; (ii) household-related risk factors; (iii) child-related risk factors and (iv) respiratory infections: (a) checkbox listing signs and symptoms of respiratory infections (cough, rhinorrhoea, nasal congestion, sputum, fever, otorrhoea, eating or sleeping disorders or other) and (b) checkbox with respiratory infections diagnosed by child's doctor (common cold, pharyngitis, otitis, tonsillitis, bronchiolitis, pneumonia or other).

Day care-related risk factors were gathered by a structured registration form handed at the day care centre to the childcare worker responsible for each child. It included questions about: (i) premises—size of the activities' room, number of children per room, type of ventilation, heating, illumination and existence of an isolating room. (ii) Hygiene behaviours—frequency of disinfection in day care premises (children's dining hall, bathrooms, diaper changes, door handles and toys); hand washing and drying policies (children and childcare workers); water drinking policies (children) and nose cleaning policies (physiological serum, saline water or nasal aspirator).

The Diary of Records and registration form were designed by an expert panel of three blinded respiratory physiotherapists with at least 5 years of experience in the treatment of children, who ensured the content validity according to Delphi's method.

From the initial group of 220 children, 201 received their caregivers' approval to participate in the study and 49 were excluded after considering including/excluding criteria and if the survey was incomplete. A final sample of 152 children was obtained.

Dependent variables

A child was considered as having experienced an URTI if caregivers reported an episode of common cold along with one of the following symptoms: (i) cough; (ii) rhinorrhoea; (iii) nasal congestion or if caregivers reported common cold, pharyngitis or tonsillitis diagnosed by the child's doctor (8,9). Moreover, it was considered that the child had experienced LRTI if caregivers reported an episode of bronchiolitis, pneumonia or other LRTI diagnosed by the child's doctor. Children were considered as having experienced AOM if caregivers reported an episode of AOM confirmed by the child's doctor. Children were considered 'healthy' if caregivers had nothing to report.

Independent variables

The study considered the following four categories of risk factors: (i) mother-related risk factors: mother's age; mothers' educational status (tertiary, secondary or primary); smoking during pregnancy (yes/no), exclusive breastfeeding (yes/no), duration of exclusive breastfeeding (months) and duration of total breastfeeding (months); (ii) household-related risk factors: number of persons living in the house; number of siblings; siblings attending day care centre or school (yes/no); exposure to smoking at home (yes/no) and parents' history of respiratory diseases (yes/no); (iii) child-related risk factors: age (months); gender; weight (kg); height (m); body mass index [BMI—weight (kg)/[height (m)]^2]; use of pacifier (yes/no); duration of pregnancy (weeks); weight, height and BMI at birth (from newborns' discharge cards) and (iv) day care-related risk factors: size of the activities' room (m^2); number of children per room; room's size/number of children; frequency of disinfection of: children's dining hall (times per day), bathrooms (times per day), diaper changes (times per day), door handles and toys (times per week); use of strategies for nose cleaning: physiological serum (yes/no); saline water (yes/no) and nasal aspirator (yes/no).

Statistical analysis

All statistical analyses were carried out using IBM SPSS Statistics 20 for Windows with a confidence interval (CI) of 95%.

Descriptive univariate analysis was used to describe variables: relative frequencies for nominal variables, median ± interquartile range for ordinal variables and mean ± standard deviation for interval variables. Data of children situated between the 25th and 75th frequency quartiles were also analysed.

Multivariate analysis (binary logistic regression) was used as a measure of relative risk. A model with four independent blocks was created: (i) mother-related risk factors; (ii) household-related risk factors; (iii) child-related risk factors and (iv) day care-related risk factors. Odds ratio (OR) and 95% CI was carried out separately for each block in order to preview the relative risk of URTI, LRTI and AOM. Backward stepwise elimination was applied, and P value ≤0.05 was considered to be statistically significant in the final model.

Results

Participants

The final sample of this study comprises 152 children aged between 4 and 36 months, with a mean age of 31.6 (±8.51) months of whom 53.9% were male. At birth, children had a mean weight of 3.17 ± 0.45 kg and a mean height of 0.49 ± 0.033 m.

Risk factors for URTI

No significant results were found concerning mother-related, child-related and household-related risk factors. So only the results of day care-related risk factors are presented. Analysing the data of the children who developed URTI situated between the 25th and 75th frequency quartiles, it was observed that they shared the activities room with 9–13 children and had 2–4.1 m^2 of individual space, compared to healthy children who also shared the room with 9–13 children but had 2.4–4.45 m^2 of individual space. Concerning nasal hygiene, children with URTI had a higher frequency of nasal aspirator use while healthy children usually used physiological serum.

Logistic regression (Table 1) shows that the risk of URTI increased as the available area per child (OR = 0.434, 95% CI = 0.206–0.914) and number of children (OR = 0.620, 95% CI = 0.411–0.935) at the day care centre decreased. Concerning hygiene strategies, the risk of URTI at the day care centre increased as the daily disinfection of bathrooms/diapers-change increased (OR = 2.56, 95% CI = 1.089–6.017). Significant results were also found for nose cleaning

Table 1. Risk factors of URTI

		URTI children	Healthy children	OR	CI (95%)	*P* value
Day care-related risk factors	Number of children in the room	10 ± 4[a]	11 ± 4[a]	0.620	0.411–0.935	0.023*
	Room size/number of children (m^2)	3.26 ± 1.65[b]	3.51 ± 1.73[b]	0.434	0.206–0.914	0.028*
	Disinfection of bathroom or diapers change (times per day)	1 ± 3[a]	1 ± 3[a]	2.560	1.089–6.017	0.031*
	Disinfection of door handles (times per week)	1 ± 1[a]	1 ± 1[a]	6.322	0.781–51.191	0.084
	Nose cleaning with					
	Physiological serum					
	Yes	65.3%[c]	80%[c]	Reference	–	
	No	34.7%[c]	20%[c]	5.296	1.097–25.559	0.038*
	Nasal aspirator					
	No	61.2%[c]	63.3%[c]	Reference	–	
	Yes	38.8%[c]	36.7%[c]	6.763	1.022–44.753	0.043*

[a]Median ± interquartile rate.
[b]Mean ± standard deviation.
[c]Relative frequencies.
*$P \leq 0.05$ is considered as significant.

strategies, revealing a higher risk of URTI if using nasal aspirators (OR = 6.763, 95% CI = 1.022–44.753) and not using physiologic serum (OR = 5.296, 95% CI = 1.097–25.559) at the day care centre.

Risk factors for LRTI

No significant results were found concerning child-related and day care-related risk factors. So only the significant results of mother-related and household-related risk factors are presented.

The analysis of frequency quartiles of children who had LRTI showed the following profile: mothers were 27–36 years old when the child was born and had higher education. Pregnancy had a duration of 38 weeks without smoking habits. The child was breastfed exclusively from 2.25 to 4.5 months and stopped breastfeeding between 3 and 9 months. In comparison, healthy children were breastfed exclusively from 4 to 6 months and stopped breastfeeding between 6 and 9 months.

In terms of household, children who developed LRTI lived in families of three members with no siblings, compared to healthy children who lived in families of three to four members and had at least one sibling. Parents did not have smoking habits or respiratory diseases.

Logistic regression for mother-related risk factors revealed that the risk of LRTI was higher if the child was not exclusively breastfed (OR = 24.612, 95% CI = 1.108–546.530). This risk increased as the duration of exclusive breastfeeding decreased (OR = 0.396, 95% CI = 0.170–0.920). In terms of household-related risk factors, the results show that the risk of LRTI increased as the household size decreased (OR = 0.213, 95% CI = 0.048–0.937) and that it was higher if the child had no siblings (OR = 7.831, 95% CI = 1.065–57.578) (Table 2).

Risk factors for AOM

Mother-related and household-related risk factors did not exhibit any significant results concerning AOM. So only the results about child-related and day care-related risk factors are presented.

The analysis of frequency quartiles showed that children with AOM are mostly boys between 15 and 29 months. At birth they weighed 3–3.5 kg and had a BMI between 13 and 15. In comparison, healthy children had a birth weight of 2.7–3.4 kg and a BMI between 12 and 14. To manage nasal discharge, most children with AOM were treated with nasal aspirators at the day care centres.

Logistic regression of child-related risk factors (Table 3) shows that the risk of AOM increased as the birth BMI increased (OR = 2.247, 95% CI = 1.011–4.992) and actual weight increased (OR = 1.607, 95% CI = 1.014–2.545). Additionally, when using a regression model that only includes strategies for nose cleaning in the day care centre, we see a higher risk of AOM if using nasal aspirators (OR = 6.763, 95% CI = 1.022–44.753).

Discussion

It is commonly accepted that day care attendance has a substantial negative influence on children's health, as they are more exposed to ARI than children who stay at home (5,6,9). Nevertheless, no previous studies about ARI risk factors in infants were conducted at day care centres in urban regions of Europe. Also, there are no studies that combine known risk factors of ARI with variables related to the day care conditions, such as the size of premises, number of children or hygiene policies.

In this study, we found that day care-related risk factors were predictive of URTI: the risk of URTI increased as the area available per child and number of children at day care decreased. Some authors suggest that a high density of children in class tends to increase their exposure to pathogens via person-to-person contact (7,8). This may be due to the behaviour of young children, who explore things with hands and mouth and lack awareness of hygiene issues, but may also be due to children's handling by childcare workers and environmental and hygiene precautions, beyond space itself (7,8,10).

In terms of hygiene precautions at day care, we find that the risk of URTI increased as daily disinfection of WC or diaper changes increased. This may be related to disease transmission at day care centres being influenced by how sick children are treated and by regular cleaning routines facing an infectious disease (7). The majority of childcare workers said that WCs were disinfected after each diaper change, so these results could be related to multiple variables, such as the number of children per class, number of staff performing cleaning routines, contamination of hands or clothing of these persons, contamination of the surface where diapers are changed or contamination of the cleaning materials which, if not dischargeable, could have been the sources responsible for spreading the infection (6,7).

An interesting result of our study is that, though day care-related characteristics were predictive of URTI, they were not significant

Table 2. Risk factors of LRTI

		LRTI children	Healthy children	OR	CI (95%)	*P* value
Mother-related risk factors	Mother's age at birth (years)	33 ± 4[a]	31 ± 4[a]	1.115	0.920–1.353	0.267
	Level of education					
	Higher	63.6[b]	70[b]	Reference	–	
	Basic	36.4[b]	30[b]	1.945	0.377–10.037	0.427
	Gestation (weeks)	38.5 ± 2[a]	39 ± 2[a]	1.263	0.719–2.219	0.417
	Exclusive breastfeeding					
	Yes	54.5[b]	59.5[b]	Reference	–	
	No	45.5[b]	40.5[b]	24.612	1.108–546.530	0.043*
	Exclusive breastfeeding (months)	2.0 ± 2.33[a]	3.0 ± 2.48[a]	0.392	0.170–0.920	0.030*
	Total breastfeeding (months)	5.6 ± 4.10[a]	6.9 ± 5.17[a]	1.131	0.918–1.395	0.248
Household-related risk factors	Household	3.00 ± 1[c]	3.00 ± 1[c]	0.213	0.048–0.937	0.041*
	Siblings					
	Yes	44.0[b]	54.5[b]	Reference	–	
	No	56.0[b]	45.5[b]	7.831	1.065–57.578	0.043*

[a]Mean ± standard deviation.
[b]Relative frequencies.
[c]Median ± interquartile rate.
*$P \leq 0.05$ is considered as significant.

Table 3. Risk factors of AOM

		AOM children	Healthy children	OR	CI (95%)	*P* value
Child-related risk factors	Age (months)	21.8 ± 9.68[a]	22.9 ± 8.19[a]	0.890	0.784–1.010	0.071
	Gender					
	Girl	37.5%[b]	48.3%[b]	Reference	–	
	Boy	62.5%[b]	51.7%[b]	1.951	0.666–5.716	0.223
	Birth weight (kg)	3.26 ± 0.38[a]	3.15 ± 0.50[a]	0.135	0.014–1.279	0.081
	Birth BMI (kg/m^2)	13.40 ± 2.04[a]	13.34 ± 1.32[a]	2.247	1.011–4.992	0.044*
	Actual weight (kg)	12.09 ± 2.59[a]	11.93 ± 2.27[a]	1.607	1.014–2.545	0.043*
	Actual BMI (kg/m^2)	17.02 ± 1.61[a]	16.80 ± 1.65[a]	0.786	1.011–4.992	0.221
Day care-related risk factors	Nose cleaning with					
	Physiological serum					
	No	35.5%[b]	30.8%[b]	Reference	–	
	Yes	64.5%[b]	69.2%[b]	0.961	0.174–5.311	0.964
	Saline water					
	No	41.9%[b]	36.7%[b]	Reference	–	
	Yes	58.1%[b]	63.6%[b]	0.206	0.025–1.719	0.114
	Nasal aspirator					
	No	48.4%[b]	65.0%[b]	Reference	–	
	Yes	51.6%[b]	35.0%[b]	6.763	1.022–44.753	0.017*

[a]Mean ± standard deviation.
[b]Relative frequencies.
*$P \leq 0.05$ is considered as significant.

risk factors of LRTI, although there is some evidence for the increasing prevalence of bronchiolitis in children attending day care centres (11). However, Fairchok *et al.* (12) reported that in spite of ARI's higher frequency of ARI at day care, it is associated with a lower severity of respiratory disease.

Recently, Chen *et al.* (8) added that the presence of a family member who also attended a day care centre was strongly associated with ARI in the household. In contrast, the results of our research showed that the LRTI risk increased as the household size decreased, and the risk was higher if the child had no siblings. However, most of the households in our sample had only three members, suggesting that households with four members had a decreased risk of LRTI if the fourth member was a sibling. These findings seems to recall the 'hygiene hypothesis' developed by Strachan (1989) and mentioned by others which suggests improvements in public health and hygiene have increased the predisposition to chronic respiratory conditions during childhood due to changes in the postnatal development of immune function (13,14). Although the 'hygiene hypothesis' lacks clinical evidence-base, some authors refer interesting results, such as Dales *et al.* (9) who stated that the adverse effect of day care attendance appears to be particularly pronounced among children without siblings at home. One possible explanation for this is that the risk of exposure to viruses from siblings approximates the risk of exposure from the day care environment, thus diminishing the difference between those who attend day care and those who do not (9). Other researchers even suggest that young children's exposure to older children at home or to other children at day care centres protects them against developing of asthma and frequent wheezing

later in childhood (11,13). Though the protective effect still remains controversial, other studies advocate that nursery school attendance is among the most important independent risk factors for wheezing and asthma (15). However, these studies focus on wheezing and asthma that have an inflammatory or atopic rather than infectious basis, so the immune system of the child is to be considered. Taking this into account, other studies connect the apparent protective effect of day care against ARI during the first year of life to the presence of protective maternal antibodies (9,11). In fact, our study revealed that the risk of LRTI was associated with mother-related risk factors, demonstrating that the risk of LRTI was higher if the child was not exclusively breastfed and that this risk showed an increase as the duration of exclusive breastfeeding decreased. The beneficial effects of breastfeeding for decreasing the child's risk of infectious diseases have been evoked in several studies, which underline the protective effects of breastfeeding against the frequency and severity of lower respiratory diseases (16). These results, however, need to be interpreted with caution regarding the characteristics of young children, such as reduced interactions, age or BMI (9).

Interestingly, our research found that the risk of AOM increased as the child's birth BMI and body weight increased. Recently, some studies have reported a relationship between Eustachian tube dysfunction and elevated BMI (17–19). There are some indications that obesity may result in altered cytokine expression, gastroesophageal reflux disease or fat accumulation, all of which may contribute to otitis media with effusion (OME). Furthermore, OME may induce taste changes through middle ear cavity inflammation, thus contributing to obesity (18). However, there is no consensus among authors about these findings, as stated by Seaberg *et al*. (19), since no relationship between AOM and increased BMI was demonstrated.

In our study, day care-related characteristics do not seem to influence the risk of AOM directly; however, when considering the strategies used at day care centres for cleaning the children's noses, there was a higher risk of AOM when the nasal aspirator is used. Only two studies were found regarding nasal cleaning in toddlers. There are many confounding variables regarding the use of nasal aspirators or physiologic serum, such as parent's education, children's positioning or type of devise used. We learned from these studies that either parents were taught to use nasal aspirators and nasal irrigation or health professionals performed the treatment, which may be cause for the reported effectiveness of their use (20). Such training did not occur in our study, which stresses its importance, as parents and childcare workers often perform nasal aspiration incorrectly and reutilize dischargeable parts, which may explain our results of higher URTI risk associated with the use of nasal aspirators.

This research faced some limitations. A relative proportion of parents may not seek for medical assistance in episodes of URTI, so we had to accept reported episodes of common cold along with common signs and symptoms described at literature by caregivers. Also, mild episodes of LRTI may not have been diagnosed, so we may have had some false negatives. Only private day care centres were included assuming that caregivers from our sample had similar incomes. It would be important to study different hand washing and drying policies, as well as different types of ventilation and heating of the rooms, once they were similar in our study. Moreover, it would be interesting to identify microbiological agents in children with signs and symptoms of respiratory infections.

Further studies are needed with larger follow-ups and including public and private day care centres from across the country. The development of primary health care measures is vital to reduce increased risk of acquiring infections at day care centres.

Conclusion

We found that URTI was related with day care-related risk factors. The risk of URTI at day care increased as the area per child and the number of children decreased and as the daily disinfection of WC/diaper changes increased. The risk of URTI was higher when nasal aspirators instead of physiological serum.

LRTI was related with mother-related and household-related risk factors. In terms of breastfeeding, the risk of LRTI was higher if the child was not exclusively breastfed and increased as the duration of exclusive breastfeeding decreased. In terms of household factors, the risk of LRTI increased as the household size decreased and was higher if the child had no siblings.

AOM was associated with child-related risk factors. The risk of AOM increased as the birth BMI and weight of the child increased and was higher if nasal aspirators were used at the day care centre.

References

1. Chonmaitree T, Alvarez-Fernandez P, Jennings K *et al*. Symptomatic and asymptomatic respiratory viral infections in the first year of life: association with acute otitis media development. *Clin Infect Dis* 2015; 60: 1–9.
2. Nair H, Nokes DJ, Gessner BD *et al*. Global burden of acute lower respiratory infections due to respiratory syncytial virus in young children: a systematic review and meta-analysis. *Lancet* 2010; 375: 1545–55.
3. Jackson S, Mathews KH, Pulanić D *et al*. Risk factors for severe acute lower respiratory infections in children—a systematic review and meta-analysis. *Croat Med J* 2013; 54: 110–21.
4. Sonego M, Pellegrin MC, Becker G, Lazzerini M. Risk factors for mortality from acute lower respiratory infections (ALRI) in children under five years of age in low and middle-income countries: a systematic review and meta-analysis of observational studies. *PLoS One* 2015; 10: e0116380.
5. Sun Y, Sundell J. Early daycare attendance increase the risk for respiratory infections and asthma of children. *J Asthma* 2011; 48: 790–6.
6. Bonfim CM, Nogueira ML, Simas PV *et al*. Frequent respiratory pathogens of respiratory tract infections in children attending daycare centers. *J Pediatr (Rio J)* 2011; 87: 439–44.
7. Nesti MM, Goldbaum M. Infectious diseases and daycare and preschool education. *J Pediatr (Rio J)* 2007; 83: 299–312.
8. Chen Y, Williams E, Kirk M. Risk factors for acute respiratory infection in the Australian community. *PLoS One* 2014; 9: e101440.
9. Dales RE, Cakmak S, Brand K, Judek S. Respiratory illness in children attending daycare. *Pediatr Pulmonol* 2004; 38: 64–9.
10. Mygind O, Rønne T, Søe AL, Henrik Wachmann C, Ricks P. Comparative intervention study among Danish daycare children: the effect on illness of time spent outdoors. *Scand J Public Health* 2003; 31: 439–43.
11. Ball TM, Castro-Rodriguez JA, Griffith KA *et al*. Siblings, day-care attendance, and the risk of asthma and wheezing during childhood. *N Engl J Med* 2000; 343: 538–43.
12. Fairchok MP, Martin ET, Chambers S *et al*. Epidemiology of viral respiratory tract infections in a prospective cohort of infants and toddlers attending daycare. *J Clin Virol* 2010; 49: 16–20.
13. Haby MM, Marks GB, Peat JK, Leeder SR. Daycare attendance before the age of two protects against atopy in preschool age children. *Pediatr Pulmonol* 2000; 30: 377–84.
14. Strachan DP. Hay fever, hygiene, and household size. *BMJ* 1989; 299: 1259–60.
15. Garcia-Marcos L, Mallol J, Solé D, Brand PL. International study of wheezing in infants: risk factors in affluent and non-affluent countries during the first year of life. *Pediatric Allergy Immunol* 2010; 21: 878–88.
16. Ip S, Chung M, Raman G, Trikalinos TA, Lau J. A summary of the Agency for Healthcare Research and Quality's evidence report on

breastfeeding in developed countries. *Breastfeed Med* 2009; 4 (suppl 1): S17–30.
17. Kim JB, Park DC, Cha CI, Yeo SG. Relationship between pediatric obesity and otitis media with effusion. *Arch Otolaryngol Head Neck Surg* 2007; 133: 379–82.
18. Lee SK, Yeo SG. Relationship between pediatric obesity and otitis media with effusion. *Curr Allergy Asthma Rep* 2009; 9: 465–72.
19. Seaberg RM, Chadha NK, Hubbard BJ *et al*. Chorda tympani nerve function in children: relationship to otitis media and body mass index. *Int J Pediatr Otorhinolaryngol* 2010; 74: 1393–6.
20. Chirico G, Quartarone G, Mallefet P. Nasal congestion in infants and children: a literature review on efficacy and safety of non-pharmacological treatments. *Minerva Pediatr* 2014; 66: 549–57.